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PROJECT DESCRIPTION

Taglu Gas Development Project

PREPARED EVIDENCE FOR
THE MACKENZIE VALLEY PIPELINE INQUIRY

Inuvik, N.W.T.

January, 1976

Imperial Oil Limited, Calgary, Alberta



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MACKENZIE VALLEY PIPELINE INQUIRY

Inuvik, January, 1976

Evidence of Panel consisting of
Glenn Goudie Mainland —
and
Barry Deane Stewart —
with respect to the Taglu Gas Development

I INTRODUCTION

The proposed Taglu gas development is to produce and process to specifications required by a gas transmission line, natural gas from the Taglu gas field and possibly neighbouring fields, if such fields are discovered in the future.

Imperial's Taglu gas development will consist of two adjacent clusters of gas wells, a gas plant and support facilities, all grouped in one location just south of Big Lake, Richards Island, N.W.T. (Figure 1).

II RESERVES, PLANT SIZE AND LIFE

The gas field was discovered in 1971 and covers an area currently estimated at ten square miles. The reservoir is composed of multiple gas bearing sands at depths between 8,100 and 10,300 feet. Likely reserves are estimated at 2.7 Tscf and individual well production rates will be 35 to 50 MMscfd.

Development plans for Taglu are still in the preliminary stage with initial field producing rate and hence the number of production wells required still under investigation. The plant design is modular providing considerable flexibility in the choice of plant size which could be as small as 0.5 Bcfd and as large as 1.0 Bcfd. The construction decision on initial plant size will be based on the established reserves at the time and near-term forecast. Future expansions, however, would be decided by the outcome of future exploration, and whether additional discovered reserves could be technically and economically fed to Taglu for processing.

The plant can be expected to be in operation for a period of over 20 years.

III LOCATION AND LAND REQUIRED

The location of the proposed development is shown in Figure 2. We favour this location for the following reasons:

- (i) Well clusters would be near the geographic centre of the field, enabling wells to be deviated most efficiently.
- (ii) Proximity of the gas processing facilities to the production wells eliminates the need for extensive

gathering lines, roads, and elaborate production equipment, and facilitates well inspection. No river channels need to be crossed and the compact development systems lessens any environmental impact.

The transmission line for the sales gas will be brought up to the plant by the pipeline owners.

- (iii) The site is close to a navigable waterway. It is, therefore, also accessible by ice road.

The land applied for will encompass the well clusters, plant site, dock, access roads, airstrip and the short, above-ground flowlines. This land, which amounts to about 200 acres, is expected to remain in use for the life of the project. Possible future expansion of the facilities may require a small additional area, as shown in Figure 3. To a larger extent, however, land must be set aside for the approaches to the airstrip runway, and safety areas around the dock and producing wells, and for deployment of contingency equipment. Altogether, therefore, the gross area required is estimated to be about 1,000 acres, as shown in Figure 3. Except for the net area occupied by the facilities themselves, the rest will remain essentially undisturbed.

IV DRILLING AND COMPLETION

Initial drilling programs could comprise about 20 wells, 10 for each cluster.

Each cluster will be situated on an elevated gravel pad approximately 500 feet by 1,600 feet including the drilling sump situated alongside

(Figure 4). Each well will be drilled to approximately 10,000 feet in 45 to 60 days. Using only one rig, the entire drilling program could take two and a half to three years of rig time to complete. We may elect to accelerate the drilling program by using a second rig if the project schedule lags through equipment delays or other reasons.

The drilling rig will be arctic-modified and capable of sliding on the gravel pads. Hole-to-hole moves will require the development of a moving system to skid or roll the rig the 100-foot spacing between holes. Development drilling operations will be similar to exploratory drilling now taking place in the area. Drilling material for three to four wells will be stockpiled on-site to allow drilling operations to continue through spring break-up and fall freeze-up when the rig cannot be conveniently re-supplied. Re-supply material will be stored at Bar C, our existing base camp. For a 20-well program, some 32,000 tons of drilling consumables, including fuel, will be required.

The drilling of Taglu wells will generate drill solids and drilling fluids removed from the drilling mud to keep it well conditioned. The total fluid generated per well is expected to be about 35,000 bbls with some 2,500 bbls of drill solids.

To limit the size of the drilling sump and facilitate its eventual restoration, it is proposed to use a subsurface injection scheme to dispose of a portion of the drilling fluid. During the winter,

all liquids will be emptied into the sump. The solids will settle out after spring thaw, and the liquid will be re-injected into the produced water disposal well which will be drilled first on the pad. After development drilling is completed, the remaining sump contents will be allowed to freeze within the sump and additional granular materials and possibly insulation will be placed over the sump surface to ensure containment and provide a future work pad.

Current onshore practices in exploratory drilling place fluids in a sump excavated below the active thaw zone in the permafrost. In the ice-rich soils at Taglu, however, the large sump required could result in excessive thawing of the permafrost and possible failure of the sump. We are, therefore, proposing an above-ground containment sump for each well cluster, Figure 4, consisting of a dyked area beside the drilling pad. The dykes surrounding the sump would be impervious, to contain drilling fluids and to keep flood waters out. Insulation will probably be placed within the dyke, to keep the embankment frozen and thus maintain its structural stability.

Wellheads will be spaced 100 feet apart in a single row on each of the two drilling pads. This spacing is determined mainly by two considerations - preventing complete thaw-back of permafrost between adjoining wells, and attempting to keep the size of the pads and hence fill requirements and the impact on drainage in the surrounding area as

small as possible. The proposed well design will have a permafrost thaw radius after 20 years' production of from 15 to 25 feet over most of the 1,800-foot permafrost section, as estimated by mathematical models. The thaw radius is influenced by the proximity of adjoining wells and, closer spacing could result in coalescing of thaw zones between adjoining wells. The consequence of this will not necessarily be serious, since because of the single row arrangement the integrity of the permafrost around the wells, in all other directions, will be far less affected. The 100-foot spacing is considered conservative and closer spacing is possible. To maintain competence in the near-surface permafrost and ensure against slumping, the top 60 feet around the well will be permanently refrigerated.

A proposed well design is shown in Figure 5. Below 2,100 feet, wells will be progressively deviated at a specified rate up to a maximum total deviation angle of 50° . The drilling mud between casing strings in the top 2,000 feet will be replaced by gelled diesel to prevent casing failure due to freezeback in the annuli when wells are suspended, and minimize heat transfer to the permafrost during production. The surface casing which runs the depth of the permafrost will be sufficiently strong to withstand all permafrost-induced stresses.

Normally, the well clusters will be operated unattended. Simple systems will be used and key items on each cluster will be monitored automatically. The well clusters will be readily accessible from the process plant and will be visited by operation personnel for routine

inspections, which might be daily during the initial operation period. Once the initial operation has established that equipment is performing properly, these visits will be made less frequently.

In general, there will be little rig activity for at least five years after the initial drilling and completion program. After that, some remedial well work and infill drilling will probably be needed. Workover frequency is estimated at one to two workovers per year, with each workover lasting 15 to 45 days. Additional infill drilling will be carried out as required and will be completed by about the tenth year of production.

The additional drilling pad area required for infill drilling will be provided during a previous winter. Whether such additional pad area will be an extension of the existing drilling pads or at a nearby location will be determined by the drilling and production characteristics of the reservoir.

During normal drilling operations, the number of personnel on site is expected to be about 35 people. At special periods such as cementing, running casing, logging, or moving, there could be as many as 55 personnel on site.

V OFFSITE PIPING SYSTEMS

Because of the compact nature of the Taglu gas development, the offsite piping systems will be quite short.

The most important offsite pipelines will be the production flow-

lines linking the wells to the processing plant. Other pipelines between the plant and the wells will carry water and liquid hydrocarbons removed from the raw gas for re-injection in their respective disposal wells, as well as refrigerant, methanol and possibly corrosion inhibitors.

In all cases, the pipes will be run above grade, supported on piles frozen in the permafrost. A minimum elevation above grade will be maintained, to protect the pipelines against any adverse effect from seasonal flooding, and prevent thermal disturbance to the tundra by the pipelines.

All lines will be insulated and designed to recognized codes and standards. Safeguards, such as leak detection control and automatically closing block valves, will be provided as well as clean-up equipment to deal with any hydrocarbon leakage.

Pipeline construction, including pile support, will be carried out mainly from gravelled areas, but where additional working space was needed, some activities will be undertaken in winter from the adjacent frozen tundra.

VI PROCESS PLANT

An analysis of the feed gas to the plant is shown in Table 1.

Gas processing will involve removal of excess water and liquid hydrocarbons from the raw gas, and compressing and cooling to produce sales gas which meets the delivery requirements of the transmission line.

The major by-products developed in the plant will be the hydrocarbon liquids and produced water removed from the gas. Some of the hydrocarbon liquids may be used in the plant fuel system; the rest will be re-injected into the reservoir. The produced water will also be re-injected. Disposal wells will be specially completed at the cluster for this purpose.

Major processing equipment will include heat exchangers, pumps, vessels, compressors for gas and propane, and gas turbine drivers for the compressors, electrical power generators and a propane refrigeration system. The plant will be largely air cooled. Small equipment may require cooling water but this will be minimal and will be contained in closed systems. All major equipment will be located inside buildings. An allowance for some expansion will be built into the plant layout, and ground space will be provided for maintenance access to the units.

The plant will be designed so that only during plant start-up and emergency shutdown will gas or liquids be released to the flare system. Plant control will be designed to reduce and/or shut off the plant feed before flaring major volumes of gas. Liquid hydrocarbons will not be flared. Instead, these liquids will be released to the main flare system, and any liquids which do not vapourize during this operation as a result of the drop in pressure will be collected in the flare knock-out drum and pumped to an emergency storage tank for later disposal. The height of the flare stack will be the shortest possible without adversely affecting the permafrost through the emission of radiant heat.

Tankage for the plant for storing water, hydrocarbon, and other products will be installed as early as possible. In this way, their capacity will be used for the construction phase when a large amount of diesel fuel will be needed. Current estimates for total tankage is 40,000 bbls. A number of the tanks will be completely fabricated and shipped to the site by barge. The larger ones will be built on site, probably in summer and early in the project.

When the plant is operating, all but the water and condensate storage tanks will be re-stocked once a year from barged supplies brought to the plant docksite. Present sizing specifications call for each storage tank to have the capacity to fill normal operating requirements for 16 months.

All liquids will be distributed by permanent piping. Piping will be installed between plant and dock to handle liquid supplies brought to the site during the summer.

VII SUPPORT FACILITIES

Plant operation will require a number of support facilities including roads, an airstrip, a dock, tank storage, buildings such as permanent housing and maintenance, utilidors and water and sewage treatment systems.

Buildings, utilidors, pipe supports, etc. would be founded on piles to ensure against settlement. Furthermore, heat-generating structures will be elevated above the gravel surface to prevent

degradation of the underlying permafrost. Both wood and steel piles will be used, depending on the design requirements. Piles will be placed in pre-drilled holes a few inches larger than pile diameter and backfilled with either a water-sand slurry or insulating material. Some 1,500 timber piles will be required, the source for which could be the Fort McPherson area or elsewhere in the Northwest Territories. A similar number of steel piles will also be used.

Gravel pads will be provided for the plant area, dock staging area, drilling clusters, airstrip and parking, road and tank storage area. These pads will be designed to protect the underlying permafrost and protect the facilities from annual flooding. For areas such as the plant and drilling pads, insulation might be used within the pads, and impervious dykes constructed along their perimeters. The feasibility of using sand cores to reduce the amounts of gravel needed is being investigated. Under heated tanks, or warm floors on grade, natural cooling with forced ambient air through corrugated ducts in the pad might be used.

Gravel pads will be elevated and drainage through them provided via culverts to prevent water from ponding against the pads. Insulation will be placed below culverts to prevent degradation of the permafrost.

It is estimated that one and a half million cubic yards of granular material will be required for construction of gravel pads for the gas plant and support facilities.

The primary source of select material known at present is the esker and kame deposits to the south of Ya Ya Lake, the location of which is shown in Figure 2. These deposits are accessible by barge in summer, and by truck along the frozen river channels in winter.

We have made a detailed survey of this source during the winter of 1974/75 to assess the quality and quantity of material in the deposits. Our current plan is to work the source essentially in summer. The gravel will be bladed off to thaw depth and pushed into windrows in the pits. When the water has drained from the windrows, the gravel will be classified and stockpiled. Trucking will begin as soon as winter haul roads are prepared and will continue through the winter. Some granular material might be barged in summer to extend the construction season.

Another source of granular material is a sand deposit at Big Horn Point approximately 3.5 miles northeast of the plant site. The river here is flanked on the east for a considerable distance by exposures of frozen ground moraine, which are constantly being eroded, sorted and deposited downstream.

A survey of this source during the winter of 1974/75 has indicated a potential 1.1 million cubic yards of very fine sand located in the river channel adjacent to Big Horn Point. Though the material would be unsuitable as a wearing surface, approximately 400 thousand cubic yards might be used as a core within the pads, which would mean that much less gravel would be needed from the Ya Ya Lake eskers. If

environmental, technical, and construction studies now under way indicate that the Big Horn Point sand is a usable source, plans will be evolved for developing the deposit.

Construction and operation of the gas plant will require short access roads connecting the plant facilities to the dock, airstrip, well clusters and flare. These roads will be designed to provide all-weather service. Road routes will be planned to interrupt normal drainage as little as possible and keep the amount of required fill material to a minimum. It is anticipated that traffic will be heaviest during the construction phase of the project.

With no year-round highway access in the Mackenzie Delta, air transport is the only means of regular rapid service to the site during nonwinter months. Aircraft will be used to transport men and perishable goods, and for unscheduled equipment deliveries.

An airstrip will be built at Taglu for use by STOL aircraft. The landing surface will be about 2,500 feet long and 80 feet wide. Critical airfield dimensions and runway lighting will conform to the appropriate Canadian Ministry of Transport Codes and Regulations. It is proposed that construction of the airfield will be scheduled early for use during construction.

To effectively handle the many types of loads, especially the very heavy plant equipment, and to re-supply on-going operations after the plant complex is completed, a permanent dock will be built on the shore of the river channel. It is proposed to build the dock as early as possible for use during construction.

The size of dock will depend on the type of barge used as well as the schedule and co-ordination of delivery during the available barging period. The exact location and design of the dock will depend on further soil investigations along the river bank. The river channels at Taglu separate at the southern edge of the proposed site and may, therefore, provide a distinct advantage for barge manoeuvring.

A staging area, approximately 500 x 350 feet will be built behind the dock for temporary storage of unloaded construction materials.

Dock facilities will also include a fuel unloading installation, consisting of a docksite manifold arrangement with either onboard or shoreside pumps.

Hydrocarbons and liquid chemicals necessary for plant operations will be kept in a tank storage area located next to the process plant. The tank farm will be enclosed by an impervious dyke large enough to contain the entire capacity of all tanks within, as well as the maximum trapped precipitation that might be impounded. Transfer lines from the tank farm to the process plant will also be within a dyked area, so that in case of a line rupture, the spilled contents could be retained for cleanup.

A permanent housing complex with room for up to 100 people will be provided next to the plant. Permanent plant operating and maintenance staff will number about 65. However, the transient presence of workover crews, summer transportation crews and visitors calls for additional space.

The warehouse, maintenance shop and garage will be built as early as possible so that they could be used in plant construction. Present plans are to build the permanent housing complex before arrival of the final plant modules, so that operations personnel can participate in the final construction phases of the plant.

The Kuluarpak Channel of the Mackenzie River immediately south of the plant is the most likely source of fresh water. Water-treatment waste streams will be combined with the sewage-plant effluent before being pumped back to the river. The water treatment waste stream will contain returned river silt and small amounts of consumed treatment chemicals. Spent carbon used in polishing water for taste will be incinerated.

The precise treatment process for domestic sewage has yet to be selected but both physical-chemical and extended aeration biological systems are potentially suitable and are currently being evaluated. The treated effluent would be disinfected, pumped back to the river in a heated utilidor and injected through a submerged diffuser.

Some six to nine pounds of solid wastes per capita per day will be generated during both construction and operating phases of the project from packaging, meals, reading materials, and consumable office supplies. Miscellaneous construction wastes, consisting primarily of packaging, crates, and skids will add a daily amount as yet unknown. Sludge from the sewage-treatment plant will amount to approximately one pound per capita per day.

All solid wastes will be collected in plastic bags and/or cans which will be carried daily to the incinerator-feed storage area in the waste-treatment building. Construction crates and skids that can be reduced to suitable dimensions will be trucked in periodically for incineration. Larger construction wastes and scrap metal will be trucked directly to the designated land-fill site at convenient intervals. Sewage-plant solids will be centrifuged to maximum concentration before being pumped from a holding tank to the incinerator.

VIII CONSTRUCTION AND TRANSPORTATION

Pre-construction activities will be limited to surveying and soil sampling at the jobsite and remote aggregate sources, and measuring and testing of the river. In all cases, this work will require only a few personnel who will commute from existing camps in the Delta or operate from one camp at the site. The work will be done in both summer and winter and will require very little equipment. Transportation will be by fixed-wing aircraft, helicopter, boat and ground vehicles.

The project schedule in Figure 6 shows the key dates for construction. Assuming startup in the latter half of 1981, gravel at Ya Ya Lake will need to be stockpiled in the summer of 1976. Personnel working at the Ya Ya gravel pit will require a small camp and support facilities. Site construction beginning with gravel hauling and spreading, erection of a temporary construction camp and support

facilities, and other sundry preparation facilities will start in January, 1977. Gravel hauling might continue by barge through the summer of 1977, but in any case, summer stockpiling and winter hauling and spreading of gravel will probably continue through to the summer of 1979. The first phase of the main construction camp will be installed during the winter of 1977/78, the balance in the following winter. Some of the plant modules may be installed in 1978. The bulk of the plant modules will be installed in 1979 or 1980. The balance of the modules and construction will be completed in 1981. The permanent operations camp will probably be erected in the winter of 1979/80 ready for startup in late 1981.

Most plant equipment and facilities will be pre-fabricated and shipped to the site in large modules. These modules, some possibly weighing up to 1,000 tons each, will be sized to fit the transportation units available. The modules will be transported to their site by barge and moved from the dock to their final location by crawler-transporters. Installation at the Taglu site will include interfacing, testing, and commissioning the pre-fabricated modules, erecting buildings and installing the interconnecting piping, controls and instrumentation from the wells to the plant itself.

Modular construction is a concept commonly used in offshore structures. It had not been extensively used on land until the advent of major construction in Alaska. Once the modules are placed on their piles and enclosed, most of the other work will be done indoors where heat and light are available.

Based on maximum use of modules, site construction will require at the most about 400 specialized tradesmen. By contrast, a non-modular construction approach would require 700 skilled tradesmen working in much less shelter under very difficult physical and climatic conditions.

Construction equipment will be much the same for an equivalent project elsewhere, except that the use of modules will reduce the quantity to some extent.

Various methods of transportation will be involved, recognizing that efficient transportation of personnel, equipment, material, goods and services is essential to the successful construction and operation of the proposed project.

Ocean-going barges carrying the larger, heavier modules will travel from the west coast to the Mackenzie Delta plant site around Point Barrow. At the mouth of the Mackenzie River in Kugmallit Bay, the barges will be lightered using river barges to reduce draft and enable a tow from Kugmallit Bay to the Taglu site. On arrival at the plant site, the modules will be offloaded from the barges onto special heavy-load crawler-transporters, moved to their final location and set on piles.

General bulk materials, equipment, and small modules built elsewhere in the south will be transported via existing rail and road networks to a riverside staging area in Hay River. Here they would be loaded onto river barges and transported down the Mackenzie River directly to the plant site.

As far as possible, standby units will be built into the design of the plant, but certain large items might have to be replaced from offsite locations. Plant replacements will be delivered by barge or aircraft either to the site or to Inuvik.

The major portion of the annual re-supply of heavy consumables, fuel, chemical, and nonperishable stores will be barged to the plant site from the rail and road heads at Hay River and will require no special barges or tugs.

Fuel will be delivered to the site in conventional bulk fuel barges. Once the barges are docked, fuel will be transferred via the re-supply pipelines built for that purpose. Steel drums might be used for certain liquids or chemicals not practicably transportable as bulk cargo.

Nonperishable bulk items of the plant warehouse stocks are likely to be transported in freight containers that minimize loss and handling at both source and site.

Perishable goods and nonscheduled items will be re-supplied by aircraft. Food and similar commodities needed for the plant's accommodation centre will be flown from Inuvik on a regular basis.

IX OPERATION

Once on-stream, the Taglu gas processing facility is envisioned as a locally controlled operation, run from a central control room at the gas plant. A sophisticated computer system will be used to maintain production control of gas from the wells, optimize the gas plant processes and undertake routine surveillance and monitoring of key operations in the whole production chain. With this type of control, a minimum number of plant operators will be needed.

Equipment will be maintained by personnel stationed at the plant site. Maintenance workshops will be equipped to meet the day-to-day requirements of the mechanical, electrical and instrument repair personnel, as well as those of special personnel brought in for major mechanical repairs. Much of the mechanical equipment in the plant will be duplicated, and a comprehensive supply of replacements will be maintained.

T a b l e 1

TAGLU PROCESSING PLANT

Feed-Gas Analyses

<u>Component</u>	<u>Taglu MOL %</u>
Nitrogen	0.12
Carbon Dioxide	0.26
Methane	92.81
Ethane	3.63
Propane	1.13
Iso Butane	0.23
Normal Butane	0.27
Hexane	0.05
Heptane	0.07
Octane	0.11
Nonane	0.05
Decane	0.10
Undecane	0.08
Dodecane	0.27
Benzene	0.04
Toluene	0.11
Xylene	0.19
Aromatic "A"	0.04
Cyclo Hexane	0.07
Naphthene "A"	0.16
Sulphur	0.00
	100.00

PERSONAL RESUMÉ

NAME: Glenn Goudie Mainland

ADDRESS: 9411 Palliser Place, Calgary, Alberta.

BORN: 1930, Edinburgh, Scotland

EDUCATION: BSc. Mechanical Engineering, University of
Glasgow, 1953

EMPLOYED: Imperial Oil Limited, 22 years

PRESENT POSITION: Manager, Frontier Planning

PROFESSIONAL
AFFILIATION: Member of the Association of Professional Engineers,
Geologists and Geophysicists of Alberta

EXPERIENCE: 1954-1974 - Technical service and research assignments in the areas of drilling, production and gas processing technology in Imperial's Production Research Laboratory in Calgary, concluding in the position of Manager of Production Research. Heavily involved in the period 1969-1974 with arctic research related to operations in a permafrost environment.

1974 - present - Manager of Frontier Planning, responsible for production-oriented planning activities in the arctic and offshore areas.

PERSONAL RESUME

NAME: Barry Deane Stewart

ADDRESS: 12203 Lake Louise Way, Calgary, Alberta.

BORN: 1942, Winnipeg, Manitoba.

EDUCATION: B.Sc.(Eng.) in Engineering Physics,
Queen's University at Kingston, 1964

EMPLOYED: Imperial Oil Limited, 11 years

PRESENT POSITION: Reservoir Engineering Section Head

PROFESSIONAL
AFFILIATION: Association of Professional Engineers, Geologists
and Geophysicists of Alberta
Society of Petroleum Engineers of CIM

EXPERIENCE: 1964-1968 Reservoir engineering assignments in
Calgary, Edmonton, Houston and
Dawson Creek.

1968-1970 Production and development program
planning and economic evaluations,
Edmonton.

1971 Natural gas engineering group leader,
Edmonton.

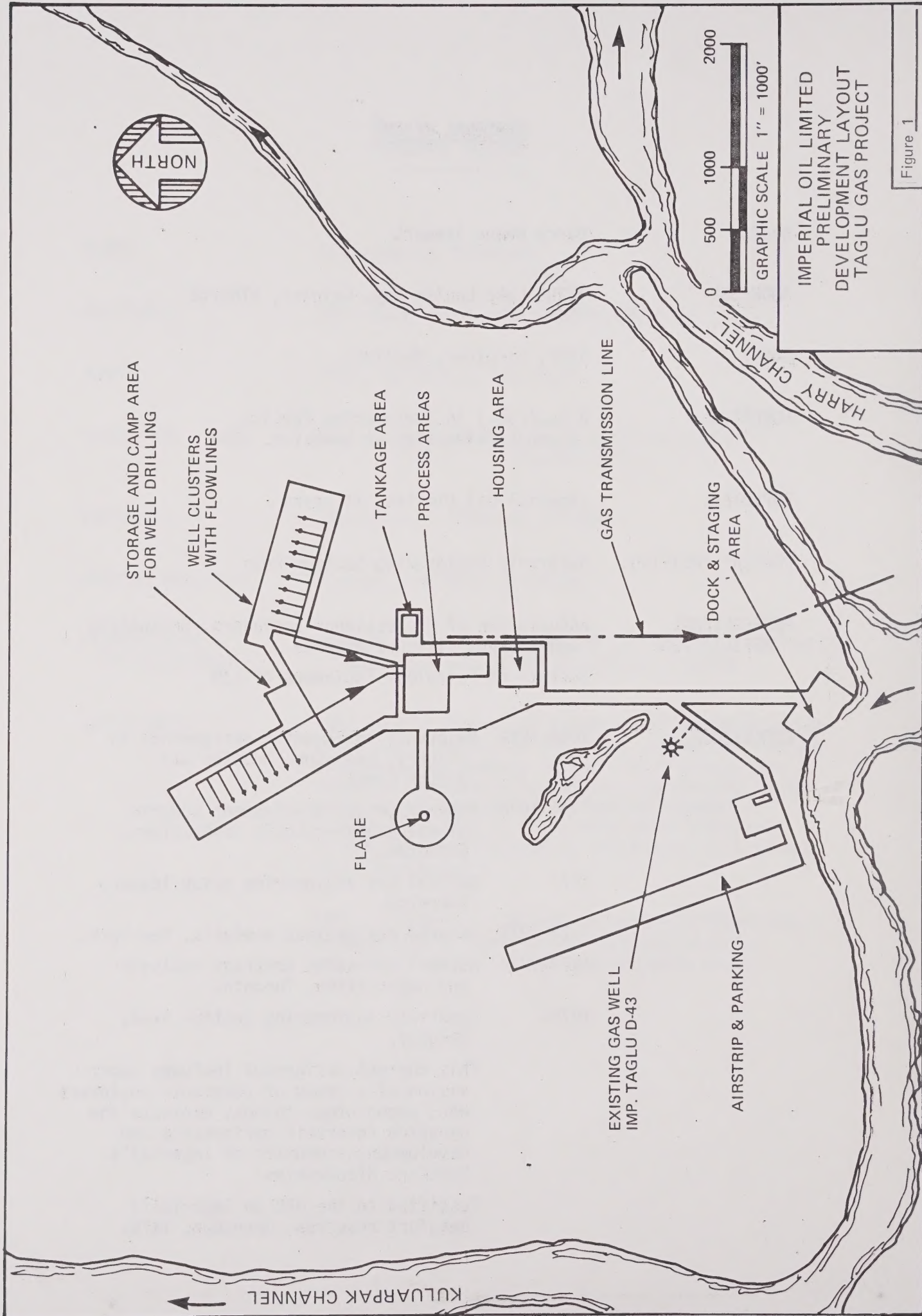
1971-1973 Natural gas project analysis, New York.

1973-1974 Natural gas sales contract analysis
and negotiation, Toronto.

1974- Reservoir engineering section head,
Calgary.

This current assignment includes super-
vision of a group of reservoir engineers
who, among other things, evaluate the
expected reservoir performance and
development economics of Imperial's
Beaufort discoveries.

Testified to the NEB on Imperial's
Beaufort reserves, December, 1975.



IMPERIAL OIL LIMITED
PRELIMINARY
DEVELOPMENT LAYOUT
TAGLU GAS PROJECT

Figure 1

30'

135°00'

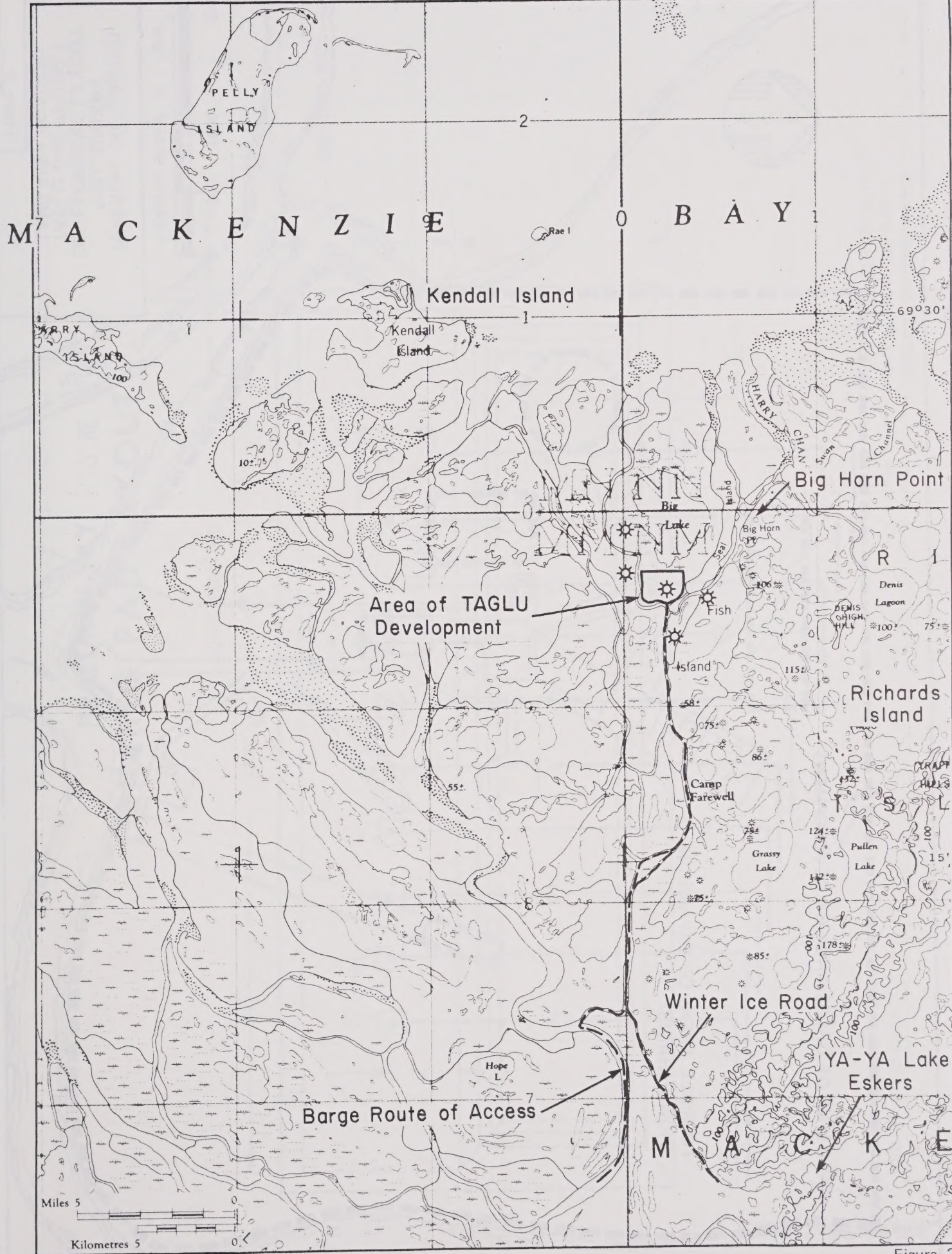
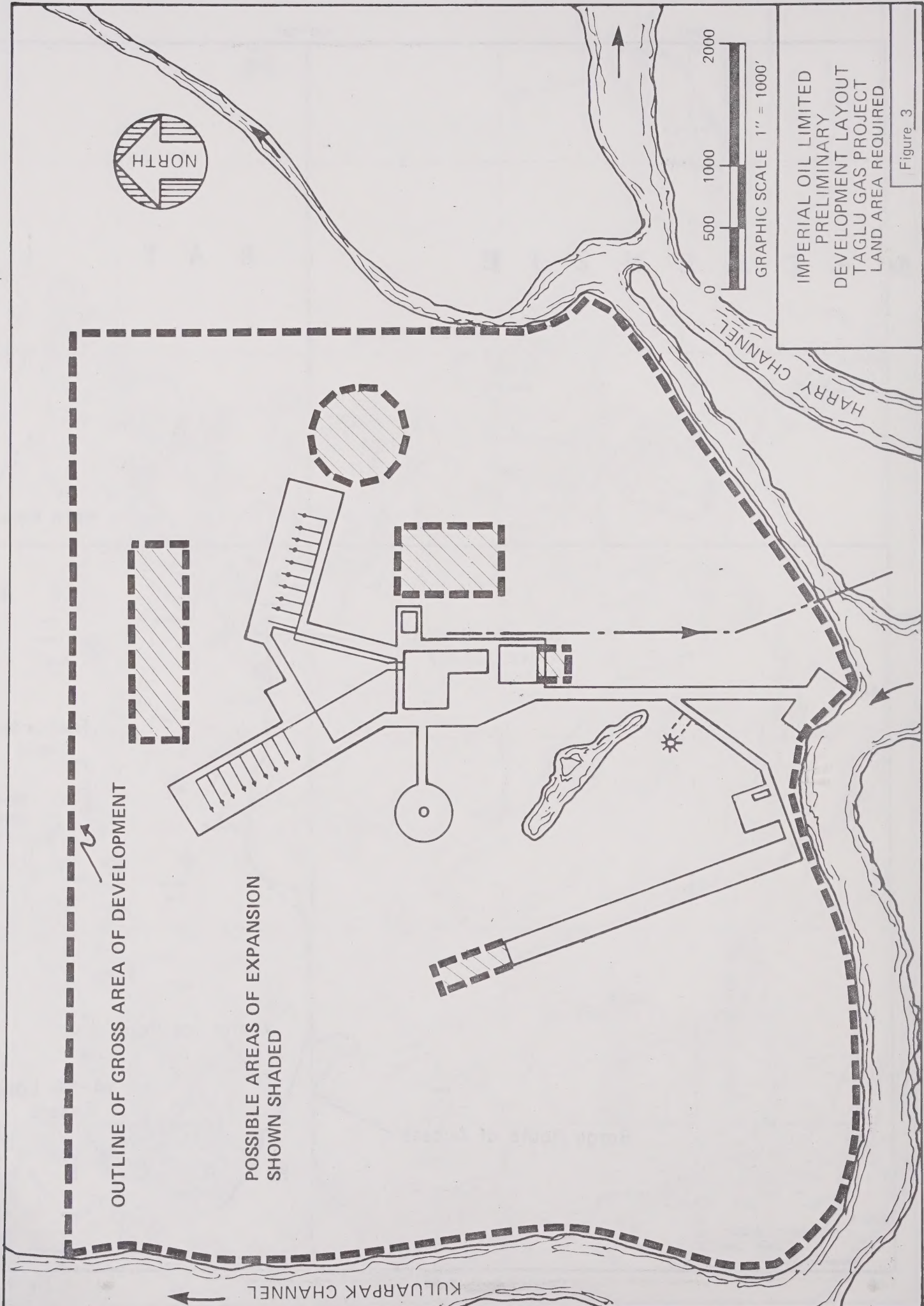


Figure 2



IMPERIAL OIL LIMITED
PRELIMINARY
DEVELOPMENT LAYOUT
TAGLU GAS PROJECT
LAND AREA REQUIRED

Figure 3

PRELIMINARY (TO BE REVISED) DRILLING PAD LAYOUT

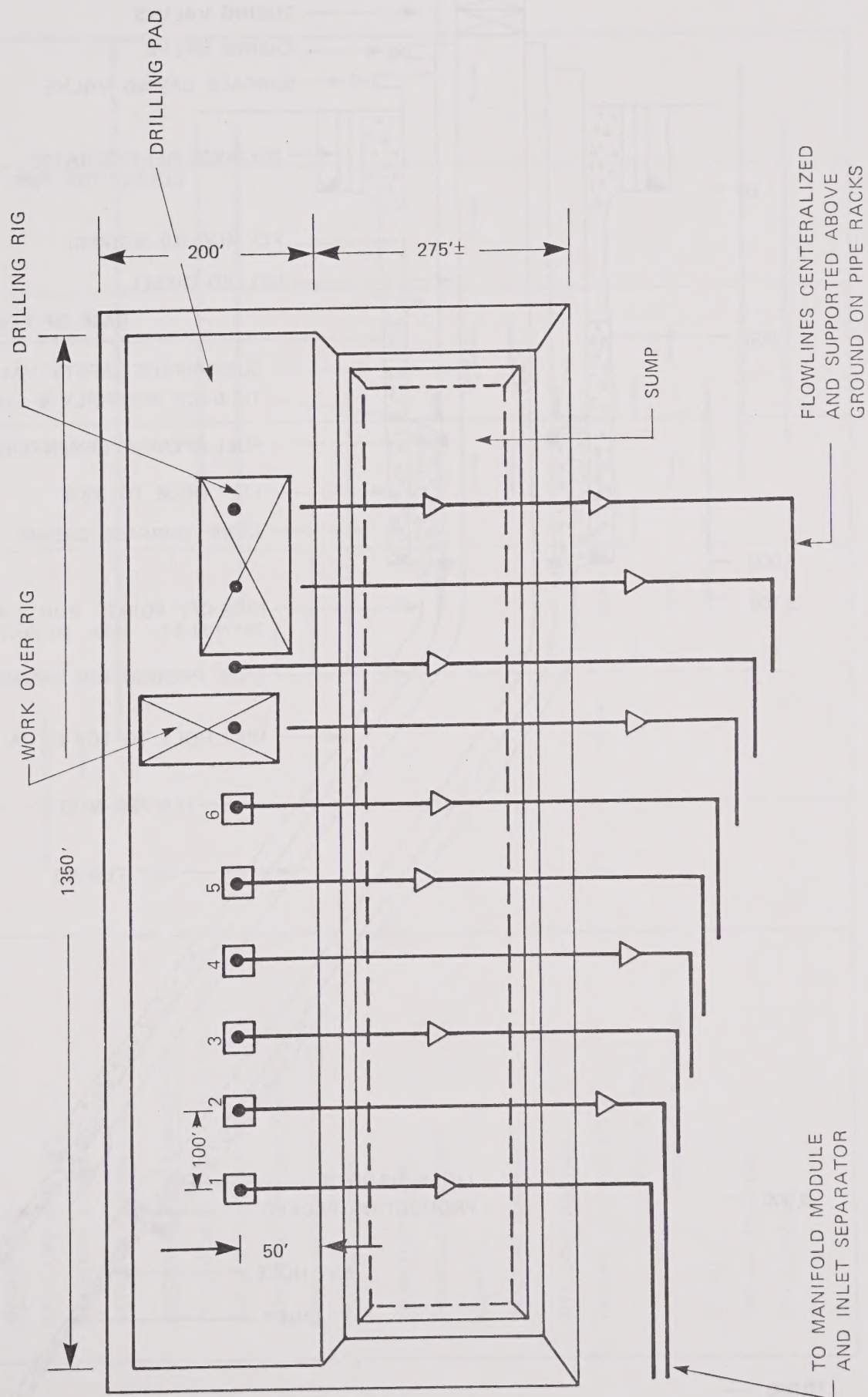


Figure 4

PROPOSED TAGLU WELL DESIGN

SEPT. 1975

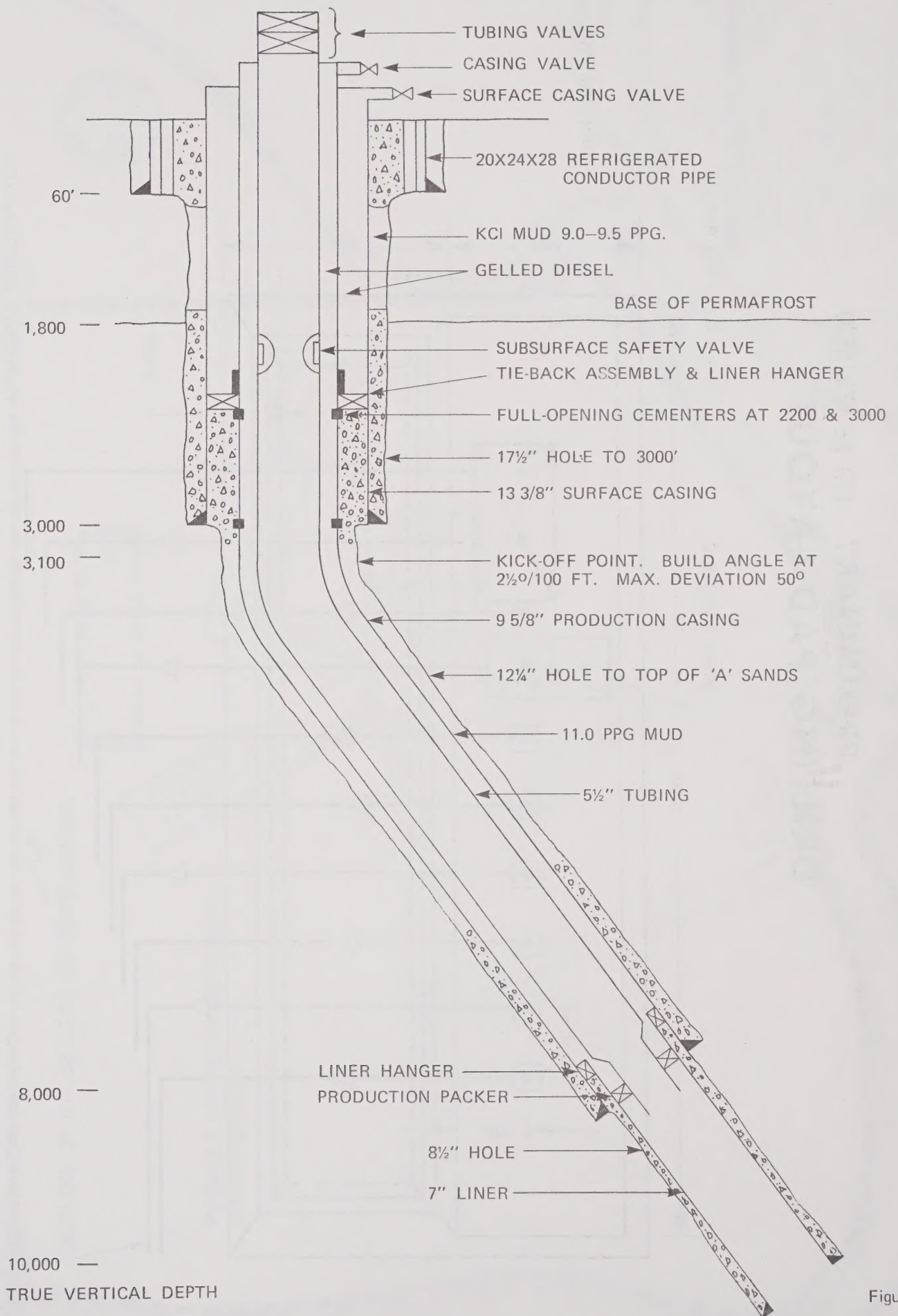


Figure 5

TENTATIVE DESIGN & CONSTRUCTION SCHEDULE

	1975	1976	1977	1978	1979	1980	1981
<u>ENGINEERING</u>							
BASIC ENGINEERING	—	—					
DEFINITIVE ESTIMATE		—					
DETAILED ENGINEERING		—					
<u>PROCUREMENT & FABRICATION</u>							
PROCUREMENT MATERIAL & EQUIPMENT							
MODULE FABRICATION			—	—			
CONSTRUCTION CAMP PHASE I			—				
CONSTRUCTION CAMP PHASE II			—				
PERMANENT CAMP			—				
<u>TRANSPORTATION</u>							
CONSTRUCTION CAMP			—	—			
MODULES				—	—	—	—
DRILLING EQUIPMENT				—	—		
<u>SITE CONSTRUCTION</u>							
GRAVEL — STOCKPILE		—	—	—			
— HAUL & SPREAD			—	—	—		
— INSULATE & SPREAD			—	—	—		
PILING			—	—	—		
INSTALL MODULES				—	—	—	—
DRILL WELLS				—	—	—	—

Figure 6

